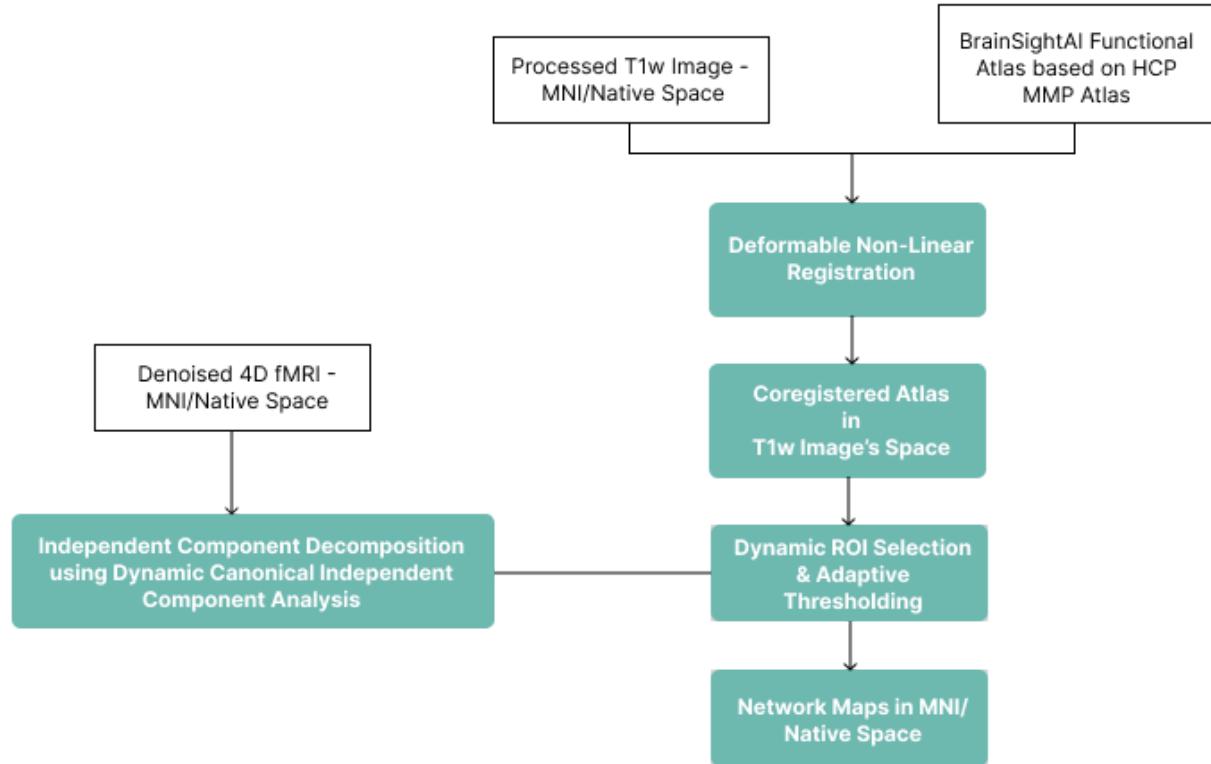


VoxelBox Plus v4.6.9

Flowchart:



Task Positive Networks: Visual Network | Primary Visual Network
| Sensory Motor Network | Language Network | Auditory Network
| Pre Motor Cortex

Cognitive Networks: Default Mode Network | Dorsal Attention Network | Central Executive Network | Salience Network

Methodology:

- 1) Outputs from VoxelBox are used by VoxelBox Plus to generate the network maps.
- 2) The 4D denoised fMRI by VoxelBox would be decomposed and compressed into independent components of 5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55, 60 components using Canonical Independent Component Analysis in separate passes to get a total of 390 independent components of different cluster sizes and voxel grouping. All the components are adjusted for False Positives using Bonferroni correction. All the processes are done using Nibabel, Nilearn, Numpy, and related computation and neuroimaging handling libraries for python. The generated ICs are stored as an array of IC images resulting in a 4D NIFTI image.
- 3) The HCP MMP atlas is registered to the given T1w's Grey Matter probability map using deformable transformation for fine mapping of the regions. The warping information is applied to SENSAAS atlas and Schaefer atlas to bring all the three

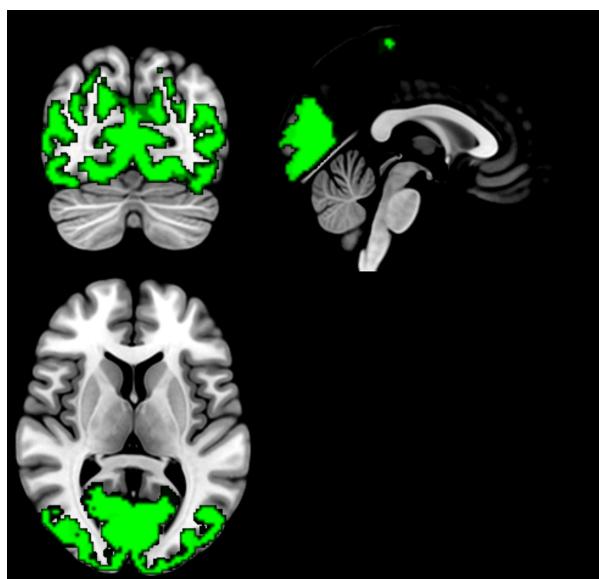
atlases to the subject's space with fine grey matter mapping. Once this process is done, different networks/regions are extracted from the registered atlases.

- 4) The 4D ICA components image is looped through and compared with each of the extracted network regions (Default Mode Network, Dorsal Attention Network, Central Executive Network, Salience Network, Sensory Motor, Language, Broca's, Wernicke's, Visual, Primary Visual) to check for similarity and overlap using Dice Coefficient Metric. The IC with the highest dice overlap score is chosen as the final IC for the corresponding network.
- 5) The intersection of BOLD activations in the chosen independent component matching the network is taken with the extracted network template to get BOLD activations only corresponding to the ROIs for any given network.
- 6) The entire process is done in either Native/MNI space, where corresponding registration transformation is applied to the HCP MMP atlas before extracting the normative network templates for the given subject.
- 7) The generated network maps are in NIFTI format which can be used to overlay on processed structural MRI (T1w, T2, FLAIR, T1CE) to visually inspect them.
- 8) All the generated networks are converted to native space that can be overlaid on ACPC Origin Corrected T1w image.

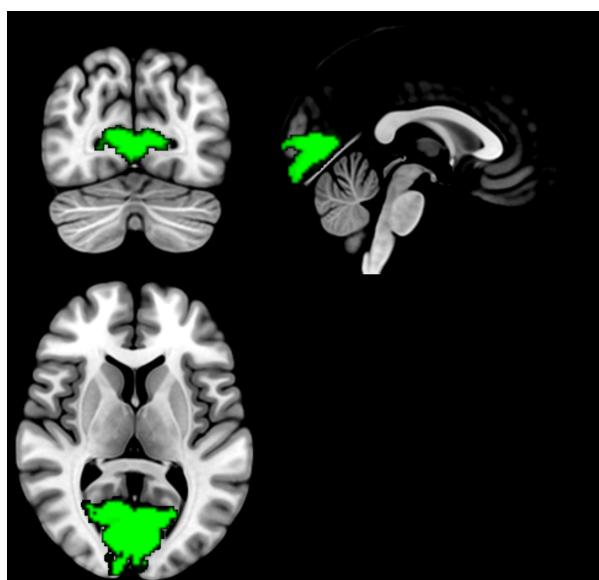
ICA Parameters:

- 1) Number of ICA Components: [5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55, 60]
- 2) Random State: 0
- 3) Number of Iterations: 200
- 4) Mask: fMRI Brain Mask
- 5) Standardize: True
- 6) Standardize Confounds: True
- 7) Strategy: template
- 8) Repetition Time: Subject scan's Repetition Time retrieved from the JSON file else retrieved from NIFTI image's header
- 9) Confounds: Friston 24 motion confounds and aCompCor confounds

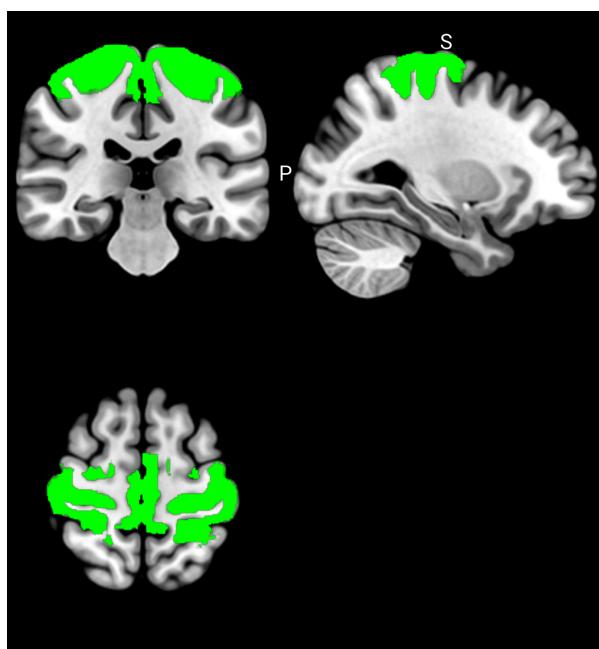
Normative Network Templates:



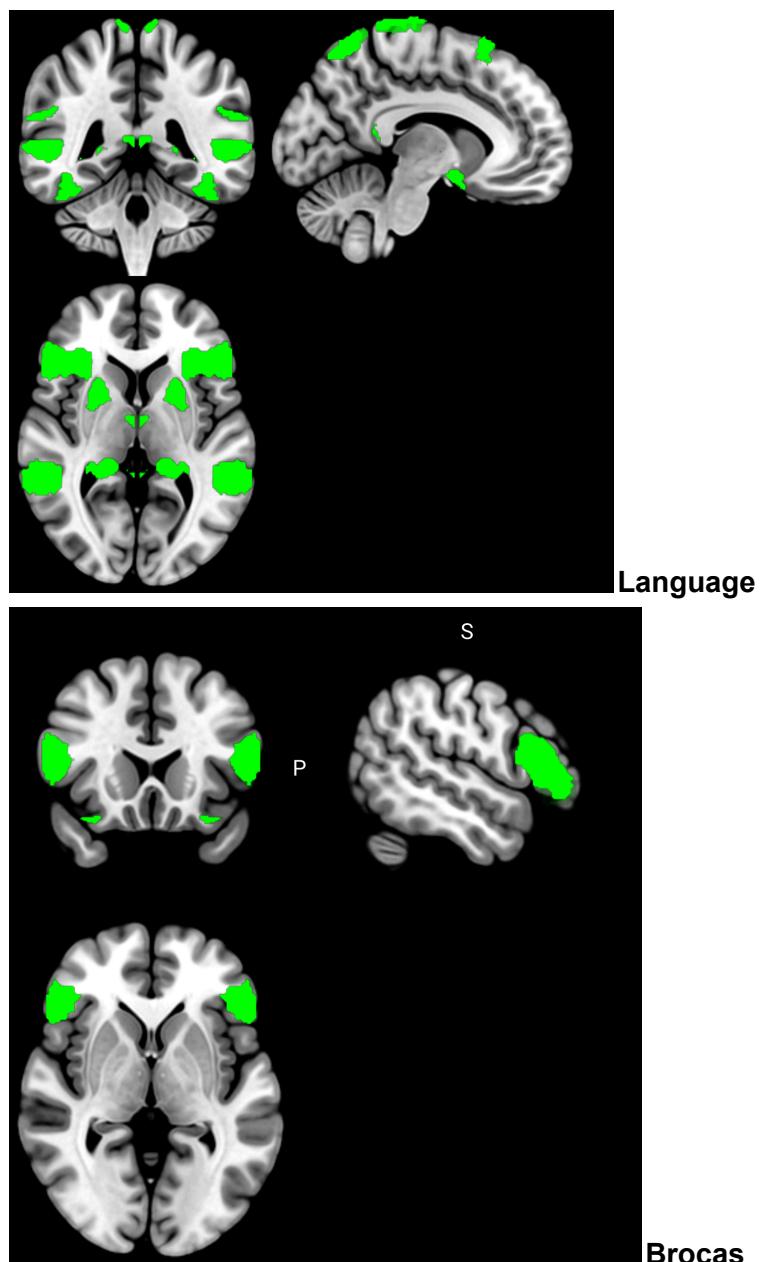
Visual Network

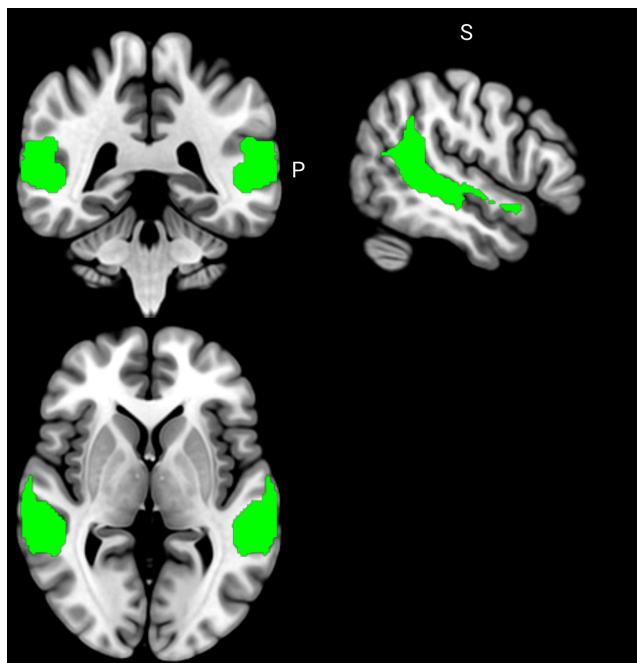


Primary Visual

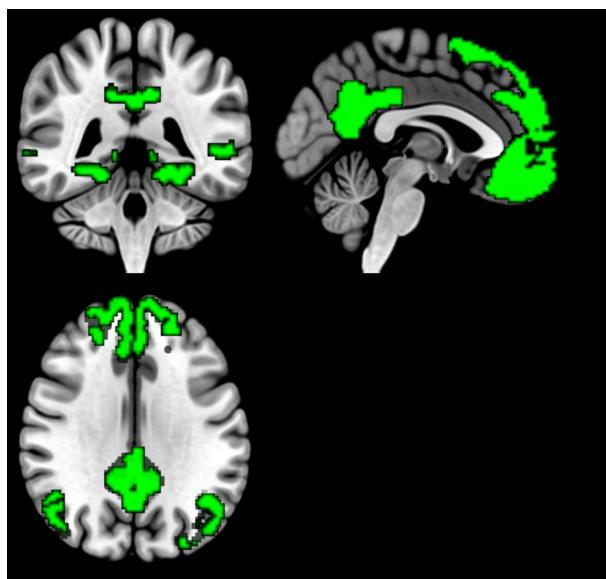


Sensory Motor

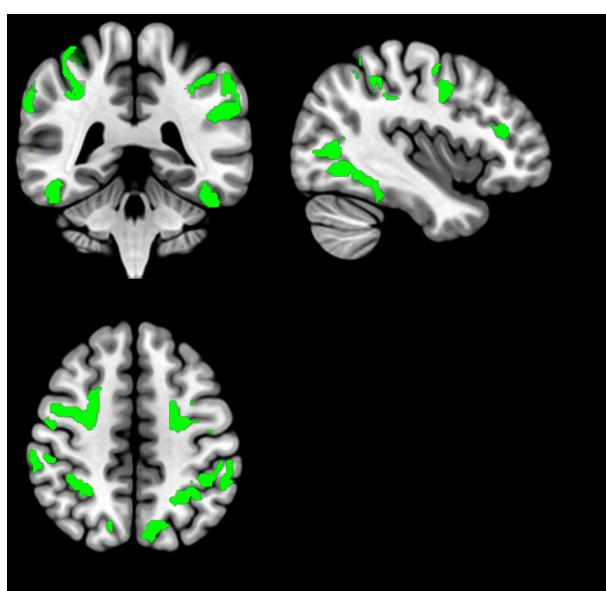




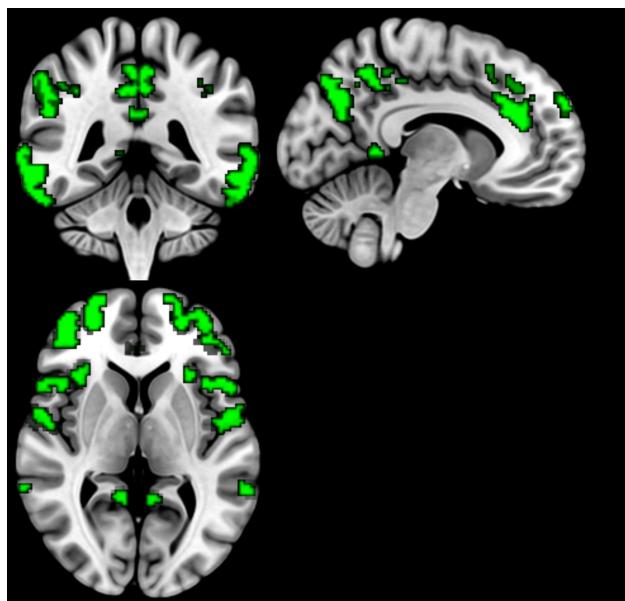
Wernickes



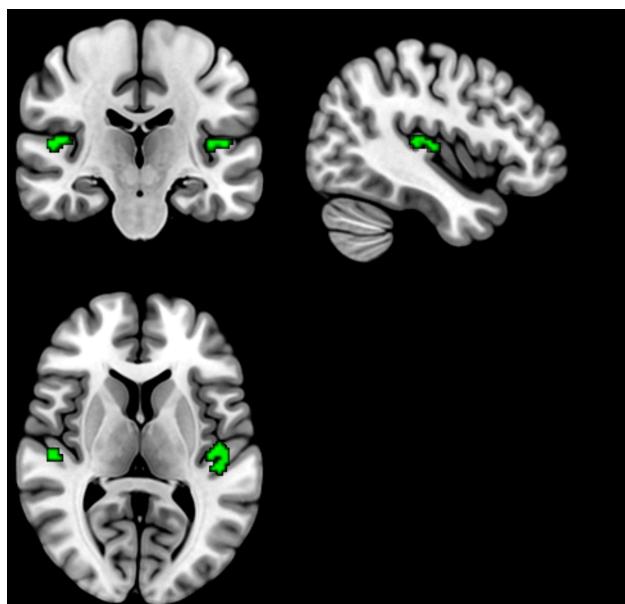
Default Mode Network



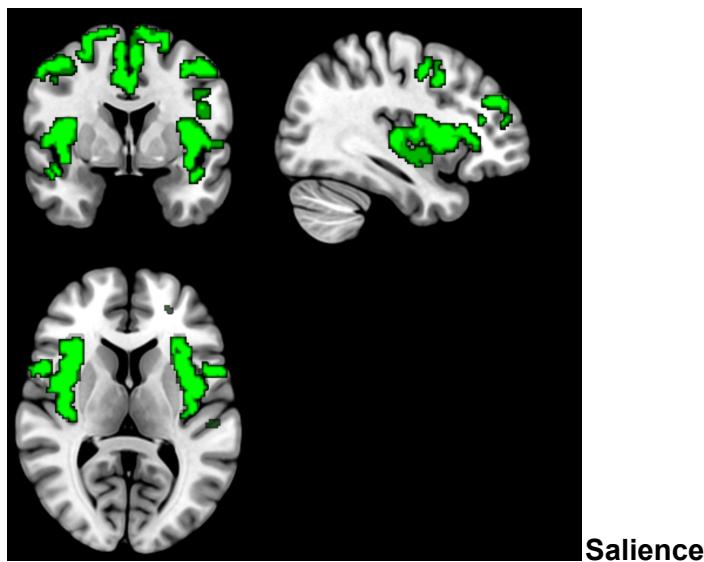
Dorsal Attention Network



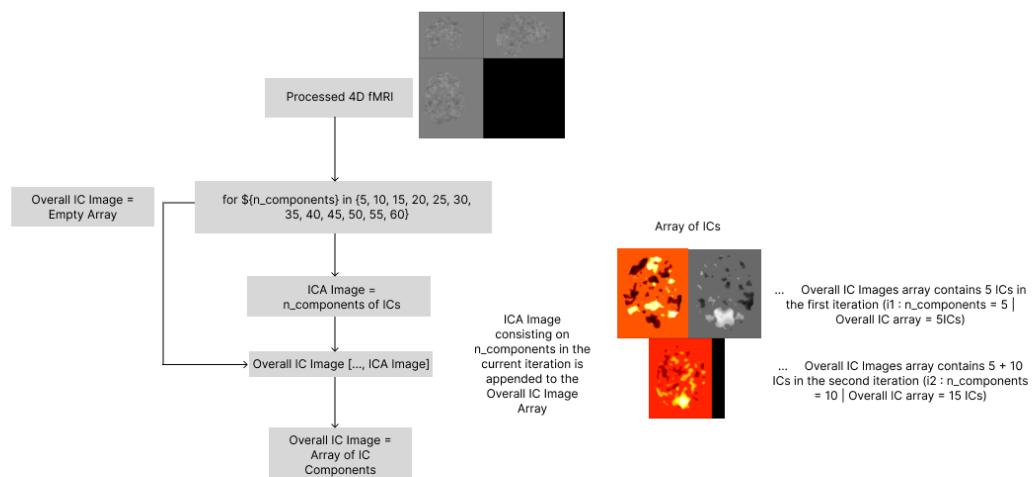
Central Executive Network



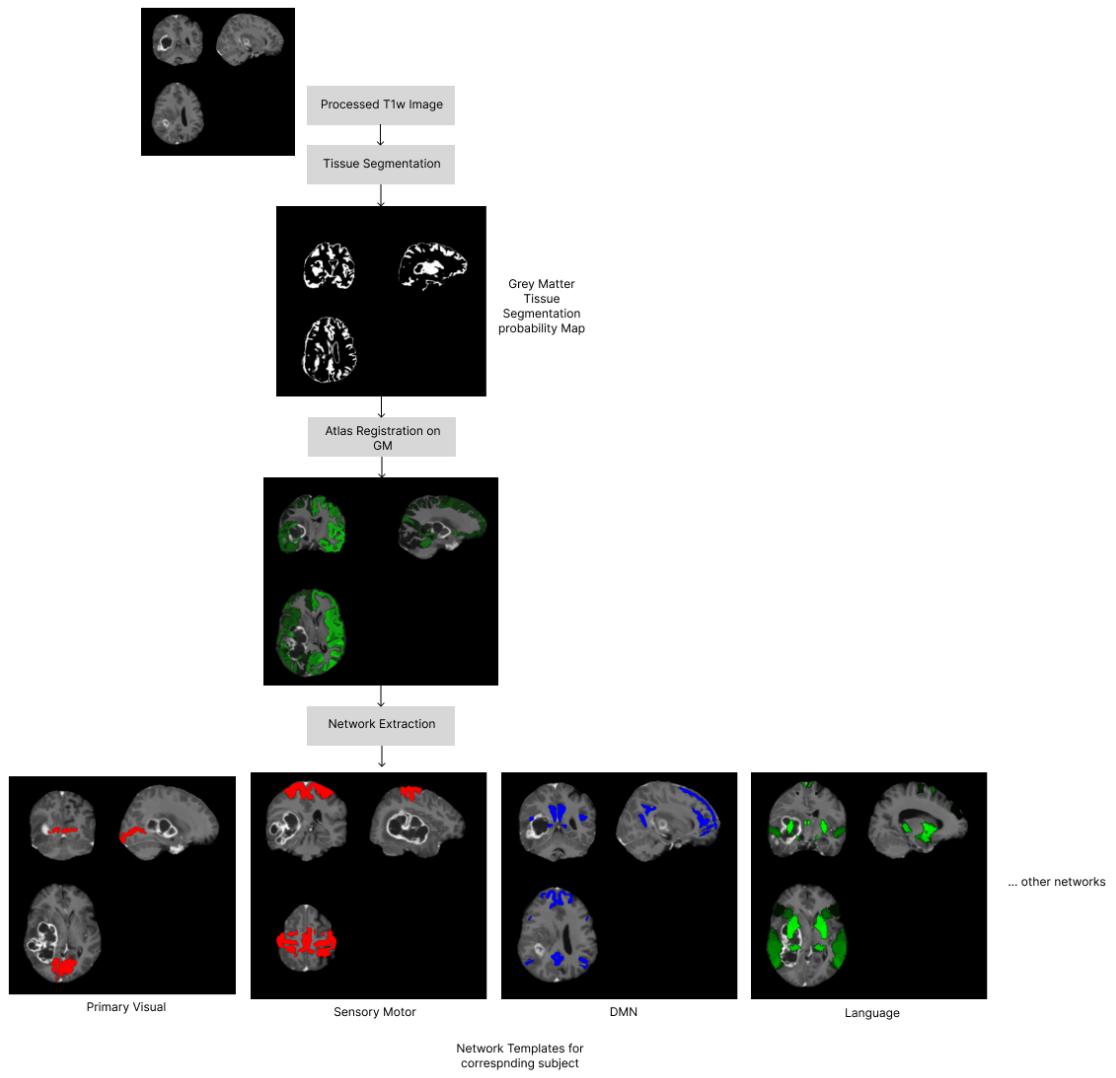
Auditory



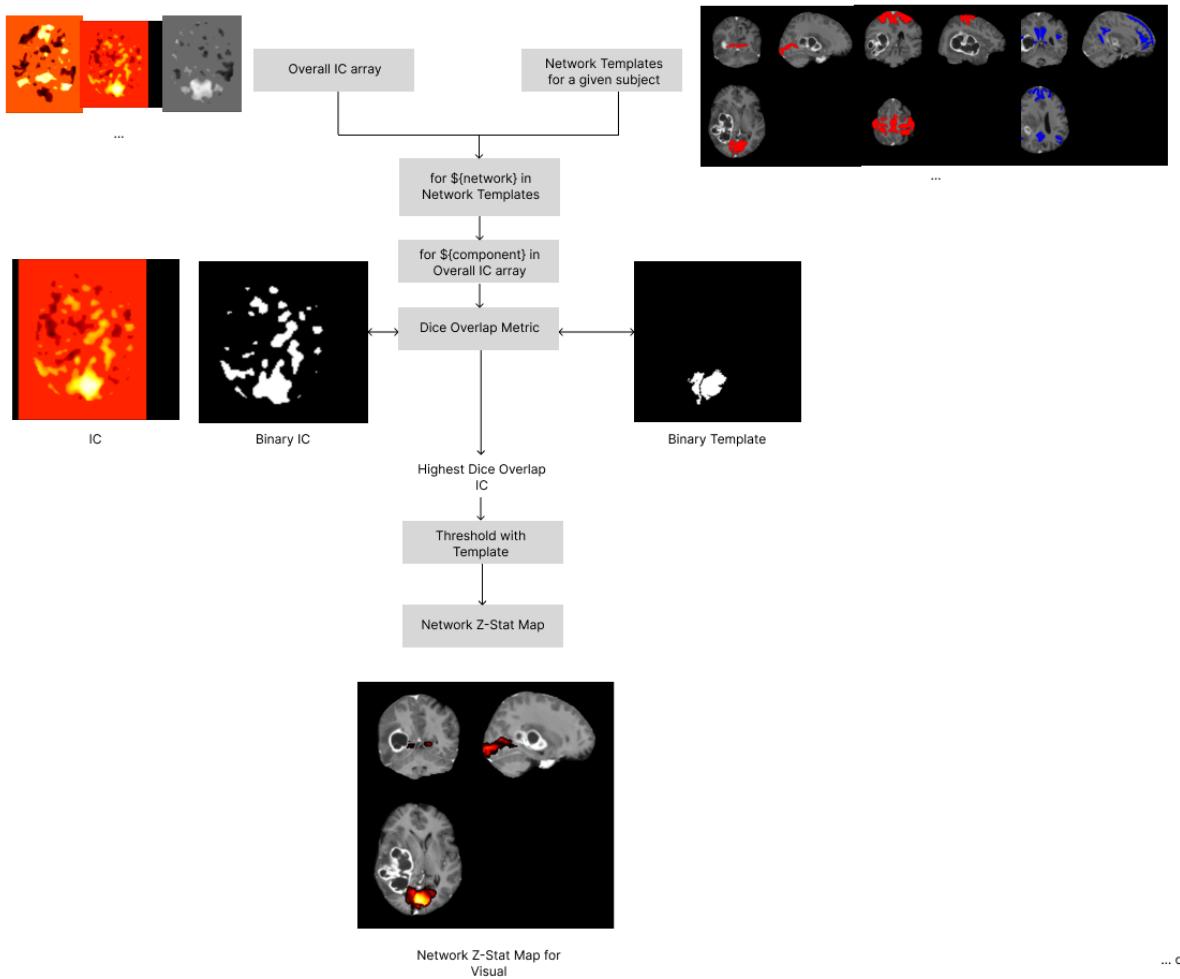
Flowchart Breakdown:



ICA Process and ICA generated images



Network/ROI Extraction process with Grey matter registration of atlases



IC selection and thresholding

Repo:

1) VoxelBox Plus Network Mapping:

https://dev.azure.com/BrainSightAI/_git/voxelbox-plus-ecl

2) VoxelBox Plus Middleware:

https://dev.azure.com/BrainSightAI/_git/voxelbox_plus_middleware

Code Documentation: docs/build/html/index.html

References:

- RestNeuMap: <https://thejns.org/view/journals/j-neurosurg/131/3/article-p764.xml>
- HCP MMP: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4990127/>
- Schaefer Atlas: <https://pubmed.ncbi.nlm.nih.gov/28981612/>
- SENSAAS Atlas: [https://www.researchgate.net/publication/329501725_A_SENtence_Supramodal_Are as_AtlaS_SE\[...\]sis_of_intrinsic_connectivity_in_144_healthy_right-handers](https://www.researchgate.net/publication/329501725_A_SENtence_Supramodal_Are as_AtlaS_SE[...]sis_of_intrinsic_connectivity_in_144_healthy_right-handers)
- Grey Matter based atlas registration and labelling: <https://support.qmenta.com/knowledge/ants-morphology-2.1.0>